ISSUED BY AUTHORITY

INTERNATIONAL HEALTH EXHIBITION

LECTURES.

PRACTICAL DIETETICS,

ESPECIALLY IN RELATION TO

PRESERVED AND CONDENSED FOODS.

A Lecture delivered in the Lecture Room of the Exhibition, June 13th, 1884.

BY

PROFESSOR F. DE CHAUMONT, M.D., F.R.S.

PRINTED AND PUBLISHED FOR THE

Executive Council of the International Health Exhibition, and for the Council of the Society of Arts,

BY

WILLIAM CLOWES & SONS, LIMITED,

INTERNATIONAL HEALTH EXHIBITION,

AND 13, CHARING CROSS, S.W.

1884.

PRICE SIXPENCE.

International Health Exhibition,

LONDON, 1884.

PRACTICAL DIETETICS

ESPECIALLY IN RELATION TO

PRESERVED AND CONDENSED FOODS.

A LECTURE

DELIVERED IN THE

LECTURE ROOM OF THE EXHIBITION.

JUNE 13th, 1884.

BY

PROFESSOR F. DE CHAUMONT, M.D., F.R.S.

PRINTED AND PUBLISHED FOR THE

Executive Council of the International Health Exhibition,
and for the Council of the Society of Arts,

BY

WILLIAM CLOWES AND SONS, LIMITED,

INTERNATIONAL HEALTH EXHIBITION,

AND 13, CHARING CROSS, S.W.

1884.

LONDON:
PRINTED BY WILLIAM CLOWES AND SONS, LIMITED,
STAMFORD STREET AND CHARING CROSS.

International Health Exhibition,

LONDON, 1884.

JUNE 13TH, 1884.

LECTURE ON PRACTICAL DIETETICS, ESPECIALLY IN RELATION TO PRESERVED AND CONDENSED FOODS.

By PROFESSOR F. DE CHAUMONT, M.D., F.R.S.

The Rt. Honble. Sir LYON PLAYFAIR, K.C.B., F.R.S., in the chair.

THE subject I have been asked to address you upon to-day is entitled Practical Dietetics, especially with regard to the use of preserved and concentrated food. The somewhat pompous expression Practical Dietetics simply means what we are to eat and drink. This is a point that to many appears a simple enough matter, and a great many persons have simply to eat and drink what they can get. But on this matter (as in all other points with regard to life) we require for the proper arrangement of diet the knowledge of certain principles to guide us, and it has been for a number of years past the object of inquiry by a great many scientific men to determine the proper constituents and proper distribution of articles of food. Amongst these gentlemen none has been more indefatigable or rendered more valuable service than our distinguished Chairman to-day. In earlier times the medical and physiological inquiry into the subject of food was very little understood, but it still is a very curious fact that in every case where people of all nations and classes have had an opportunity of getting proper food they have almost invariably, I will not

say by instinct, but probably by practical experience, selected that form of diet and that arrangement of food which appears best to suit the position in which they are and enable them to make the best use of it. By analysing all the different diets of nations of the earth this remarkable fact comes out that where the articles can be procured the diet has generally formed a good diet for the position in which the individual is placed.

Now, the objects for which we take food are various. In the first place we require food of a certain character, which is known as nitrogenous food or albuminates, for the purpose of building up the tissues of the body in the time of growth and repairing them in the time of adult life and old age. And, secondly, we require other food which is generally called non-nitrogenous or carboniferous, including fat, starch, sugar and the like, for the purpose of consuming these in the body by means of the oxygen in the atmosphere, and so getting that amount of energy which is necessary both to support the animal heat of the body and also to produce actual visible practical work. Besides that we require other substances, such as mineral salts, which are absolutely necessary for the carrying on of the functions of the body; we require them for the purposes of digestion, and also for the purpose of regulating the way in which the different constituents of the food are taken up and assimilated. And in addition to all these we may say there is still another class which has been generally included among the carboniferous, and that is the class of vegetable acids, such as citric acid, tartaric acid, and the like, which are present in all fruits and in most vegetables combined with certain bases. They perform a most important function in the system, and the absence of them produces a disease which used to be well-known in former days, the disease called scurvy, which has by no means disappeared from the community at the present time. Now, in order to determine what constituents of food are absolutely necessary it was shown by the late Dr. Prout, one of our first English organic chemists, that milk represented most accurately

the only form of food which was able to support animal life without any addition ; and the composition of milk consists, out of 100 parts, of a great deal of water—86·7 ; 4 per cent. of albuminates in the form of cheese ; 3·7 of fat in the form of butter ; about 5 per cent. of what we call carbo-hydrates which include starch and sugar, represented by milk sugar ; and, lastly, a small proportion, about ·6 of salts or mineral matter. Now we are all perfectly familiar with the fact that the young of every animal, including man, ought to be nourished solely from milk derived from the parent ; and on that milk they can grow and flourish and ultimately become healthy and strong. Therefore it has been concluded, and justly so, that milk represents in this way the main constituents of diet which are necessary for life.

But when we consider the relative proportion in which these constituents are present in milk we find the proportion is not such as would be suitable for the life of adult people. On the contrary, in cases where we are obliged for medical reasons to restrict people to a diet of milk alone, it is undergone with very considerable difficulty, because to get a sufficient amount to support a man we require to give a very large quantity—something like 9 or 10 pints of milk a day, which is an immense amount of liquid for the human stomach to deal with. Therefore, although we admit that milk gives the best form of diet ; that it gives all the necessary elements of diet in the main ; yet the proportions are not such as would be proper to give to adult people for the ordinary purposes of nutrition. We have a disproportion chiefly in this way that there is much too large an amount of nitrogenous matter and fats, compared with the carbo-hydrates. In fact we ought to give more carbo-hydrates, such as are generally given in ordinary diet in the form of starch, to get a diet which will suit most individuals. I am sorry to say that a diagram I intended to have here to show the constituents of a standard diet has not arrived ; but I can illustrate it by this diagram, giving the diets of different armies, which was put

up to show what ought not to be the arrangement of diet.

DIETS OF EUROPEAN ARMIES IN WATER-FREE FOOD, IN OZS. AVDS.

	English.	French.	Russian.	Austrian.
Albuminates . .	3·86	4·33	4·02	3·73
Fat	1·30	1·27	1·09	1·64
Carbo-hydrates . .	17·43	18·04	19·62	17·00
Salts	0·81	1·00	1·50	1·00
	23·40	24·64	26·23	23·37

The average of these diets, which differ but little among each other, shows the following constituents: The nitrogenous or albuminates 4; fat 1·3; carbo-hydrates 18; and salts 1. In a proper diet there ought to be more albuminates, two if not three times as much fat; but there is too large an amount of carbo-hydrates in this dietary for the rest of the constituents, and a very much larger amount than we find in milk. But this is the direction in which the chief change takes place in arranging diets of adult people for the ordinary business of life, in a proper standard diet for men to go through ordinary daily work, viz., a larger proportion of starchy matter. We generally require 4½ to 5 ounces of what is called albuminate food, about 3 of fat, and about 14 or 15 of starch and sugar, and a small quantity, about 1 oz. of mineral matter or salts, the whole making up about 23 ozs. of solid food.

One point I must refer to here which bears strongly upon the question of concentrated or dried food. We must bear in mind that all so-called solid food that we have to deal with contains a very large amount of water. Even the very driest substance we have to deal with, such as a dry ship's biscuit, which does not appear very watery, still contains a certain amount of water, about 8 per cent. Even flour, which seems a dry substance, contains something like 15 per cent, and so on. There is another table on the wall which will show the large amount of water contained

in the great many ordinary articles of diet which are used for usual dietary purposes. For instance, every pound of butcher's meat, a beefsteak for instance, which when we buy we think is solid food, contains about 75 per cent. of water, so that there are only four ounces of actual solid food in it. Take again a potato—a pound of potatoes is exactly in the same position—there are only four ounces of actual solid matter in it; and if we go to other substances such as succulent fruits and vegetables, we find even a greater amount. In fact in the average composition of cabbage, for instance, there is more water than in milk; although cabbage is apparently a solid article it contains about 91 per cent of water; and fresh onions even more—as high as 94 per cent—whereas good milk contains only 86 to 87 per cent. Now this is a matter of very great importance, and as the different articles of diet vary so much in the quantity of water they contain, it is obviously impossible to give anything like a scientific statement of the amount of food that is necessary, unless we make that statement disregarding the water which is swallowed with the food. Consequently, we make all our statements of this kind in what are called terms of water-free food; that is taking the amount of albuminates, carbo-hydrates, fats, and so on, we know to be present in an article of food, excluding the water from it. Therefore when we say a diet consists of 23 ozs. of food we mean food theoretically water-free, that is actual solid matter which cannot be reduced any further by the action of drying or any means whatever.

Now let me refer again for a moment or two to the functions of different articles of diet. I have already pointed out to you that albuminate food which contains nitrogen is necessary for building up and repairing the tissues. We have a body which is exceedingly remarkable in this point, that while we can consider it with great truth as equivalent to an ordinary mechanical engine, it has this great peculiarity about it, that while we stoke the engine with fuel we also carry on its repairs without

stopping the machine, and the repairs are carried on by means of this nitrogenous food. Nitrogen, which forms four-fifths of the atmosphere, forms a very large constituent of all our tissues whatsoever. There is not a single tissue, fluid or solid, which does not contain nitrogen. But there is another very remarkable function that this nitrogenous food seems to exercise. This has been proved experimentally; it acts not only by repairing the tissues, but also in a remarkable way in determining and controlling the absorption of oxygen from the atmosphere through which all the chemical changes go on in the body which are necessary for existence. Now, this has been shown by feeding animals upon food deprived to a considerable extent of nitrogen, and under these circumstances the functions have not gone on; the proper amount of oxidation of the non-nitrogenous food has not taken place. I may give a very curious instance to this effect by referring to the case of the well-known Mr. Banting, whose corpulent condition was a matter of common talk some years ago. This gentleman was an undertaker in St. James' Street, who had the misfortune to grow so fat that he weighed 300 lbs., and could only go downstairs backwards. He tried a great many things to reduce his corpulence, and at last he took the advice of his medical man, Dr. Harvey, who suggested that he should live in a certain way, for instance, that he should give up to a large extent fats; to a still greater extent sugar and starch, and increase the amount of nitrogenous food. The result was, that within a reasonable time he reduced himself to the size of a stout but still a moderately stout man. Now the action in this case was two-fold. In the first place he cut off the sources of fat, and in the second place he took more of the particular parts of diet which determine the assimilation of oxygen, and its union by combustion with the non-nitrogenous food. The functions of the other parts of our diet, viz.: the fat and the starch and sugar, are also more or less complex, but the chief action is that they should undergo oxidation, and by that means produces a certain quantity of heat which is

either retained as animal heat in the body, or turned into external physical work in the ordinary work of life. But there is also another function which starch and sugar perform, that is the production of fat in the body, because the fat we take in our food by no means accounts for all the fat that we have, but a great deal of it is produced by the conversion of sugar into that material.

I have referred already to the function of the vegetable acids in maintaining a certain condition of the blood. Now, if the blood is in a proper healthy condition it is alkaline, that is to say that it will unite with an acid, that it will turn some vegetable colours green, and other vegetable colours brown, and so on, but if it gets into an unhealthy condition, and chiefly in consequence of being deprived of vegetable food in that particular form, then it becomes less alkaline, and in consequence gets into a fluid condition, does not coagulate as it naturally would when it is set free, and the result is, the disease we know in its extreme form as scurvy. Now, this disease in former years was the scourge of our navy, and it is on record that the channel fleet in the middle of the last century had sometimes come into Spithead with no less than 10,000 men disabled by scurvy alone; and one of the reasons why the enormous hospital at Haslar was built to hold 2,000 patients was on account of the tremendous stress put upon all hospital accommodation by the enormous number of scurvy patients. This condition of things was remonstrated against by the medical officers of the Navy, who pointed out the remedy at hand by the use of vegetable acids a long time before it was adopted, but as soon as it was adopted the result was magical. Scurvy disappeared from the navy altogether, and that immense hospital at Haslar was left with only a few cases compared with what it was intended to accommodate. But I should mention that scurvy has by no means disappeared entirely, and so far is it from disappearing, that if cases are carefully investigated in ordinary life, even among the better classes, we shall find symptoms of scurvy from time to time. A great many

people dislike vegetables, and even dislike fruits, and neglect the use of them. Others from sheer ignorance do not use them, and the result is that again and again diseases that are apparently caused by quite other means are aggravated and complicated by a certain amount of this scorbutic taint. I have seen cases of this sort myself, and I know other physicians who have told me that cases have come under their notice.

The remedy is very simple, the use of fresh vegetable food or its equivalent in lime juice or other forms of vegetable acid.

Now, it is a very remarkable thing that, although we have certain knowledge of the principles of diet, and know that a certain amount is required in certain proportions in order to get proper results, that we should find, in every case where a corporate or official diet is arranged, dietetic errors occur, and always in the same direction, and I cannot point to a better instance than those four columns of diets in the principal armies of Europe, which show very clearly how this is the case.

Take the English army's diet ; in the first place the amount of albuminate food, as given in the usual diet, in something under 4 ounces. Now, in the proper diet for a man of the ordinary size and weight of the British soldier, he ought to get at least one ounce more than this. In the case of fat, on the other hand, instead of getting 3 ozs., which he ought to get, he only gets a little under $1\frac{1}{3}$ oz. He gets rather more starch than he requires--$17\frac{1}{2}$ ozs., whereas 14 ozs., or 15 ozs., would be quite sufficient if he got other articles. The salts are practically pretty near the amount required. If we look along these columns of diet we find that with very small differences in dietary, the results are exactly the same in the different armies. In the French army we have the same deficiency in fat ; a little more albuminates, but this is due not so much to the increase of meat, but to the greater use made in France of leguminous foods—that is, beans and peas, which are very nutritious. The same excess of carbo-hydrates exists. In the Prussian

army we have almost identically the same condition of things, but the Prussian soldier gets only 1 oz. of fat: and the same is the case in the Austrian army. If we were to examine the dietaries of prisons and other places, we should find the same mistake runs through them all. Now the cause of this is in the first place ignorance; and in the second place, the fact that these particular articles of diet are rather dearer than the others, and consequently a very considerable increase of expense would be incurred if they were to be ordered. Some years ago there was a considerable movement for getting a larger meat ration for the English soldier, which I certainly think he required, but on calculating the amount of the increased expense which would be incurred, taking the whole of the army, it was found that it would come to pretty nearly half a million per annum; and this was so considerable an addition to the estimates that it would have been a very bold Chancellor of the Exchequer who would have proposed to introduce it, at least without considerable preparation of his audience. The English soldier is in one way somewhat better placed than his brother in other armies; he has a little more pay, and consequently he can spend a little on additions to his food, which he generally does; but in foreign armies the soldiers get very little pay, and consequently they can have very little addition to the actual diet which is provided for them, and therefore they no doubt suffer in consequence.

Now in reference to the question of preserved and concentrated food, this is a point which is very important to all the community, but especially important for public institutions, for troops, and the like, and if the use of this form of food can be carried into effect, the result will be highly beneficial in many ways. In the first place, we can save to a large extent food which otherwise must be wasted for want of a market near the spot. Secondly, we can provide in case of deficiency of ordinary food, wholesome forms of food which can be easily used and properly assimilated. In addition to that we can get ready under

certain conditions particular articles of diet which are not immediately obtainable, but which are necessary for the preservation of health. There is, however, a certain amount of difficulty connected with food of this description, and a good deal of confusion arises with regard to its nutritive value. It is necessary to draw a very distinct line between food that is merely preserved and food that is concentrated or dried. In food that is merely preserved what is done is to take the food generally cooked to a certain extent, and seal it up so as to retain it in that condition. Under those circumstances there is no concentration; it is simply preserving the food from change in its cooked form. On the other hand, when we come to deal with food which is concentrated, we do this by driving out a large quantity of water; and therefore a ration of this food is very much more nutritive, weight for weight, than a ration of ordinary food. But it is necessary we should bear in mind that there are these two different conditions, because I have known the mistake made of looking on merely preserved food as equivalent to concentrated or dried food weight for weight. On one occasion I remember where certain vegetables ran short and preserved provisions had to be resorted to, it was proposed to divide the rations as if those referred to dried food instead of merely preserved, and the consequence would have been that much too small a ration would have been given, but fortunately the mistake was discovered in time.

Now there are various ways of preserving and preparing foods. In the first place if we take food that is simply dried, which has been a very common method of preservation in all ages, we find this can be done with tolerable ease, and will keep to a certain extent the nutritive properties of food intact. As regards meat, for instance, a familiar form of this is the dried meat used so largely in South America under the name of Charqui or Tasajos. It is simply dried in the sun, and remains sweet, and does not undergo change for a very long time. Making use of this Dr. Meinert of Berlin, a very scientific enquirer and manu-

facturer of preserved food, has instituted a manufactory for a particular meat powder (Fleisch Pulver), derived to a large extent partly from this dried meat of South America and partly from fresh meat obtained from different parts of Europe where it is cheap, and the result has been to produce a form of meat which has undergone apparently very little change in the process of drying and preparation, which can easily be applied in various ways for dietetic purposes. I am sorry there is no specimen here to show you, but it is really a very valuable form of food.

Then as regards the drying of other materials, such as vegetables ; that is familiar to everybody in the form of Julienne, so commonly used for making soup, where we have the vegetables dried up, but they take up water, and swell out again to their natural form, and make a very useful article of diet. There is, however, one point that we must bear in mind, that the drying can only be carried to a certain extent.

We sometimes hear people talk of concentrated food that can be carried in the waistcoat pocket, or even in the form of a small lozenge, to last for twenty-four hours. This is all mere romance. A man must have a certain amount of food, or he cannot go on working, or even exist. The smallest amount of food necessary for existence is represented by about fifteen ounces of water-free food—nearly a pound, and that is the lowest weight it can be reduced to; and if you take the amount required for a labouring man's food, you cannot reduce it below one-and-a-half pound theoretically. There is another point, however ; this is merely the theoretical quantity ; but if we were to drive off all the water in this way by a process of drying, we should leave the food in such a state that it could not be taken up and assimilated by the system. On one occasion I had sent to me for examination some samples of what was called meat biscuit, which was proposed to be given to troops on a campaign. It was said to contain in a single biscuit, or perhaps two, food sufficient for a whole day,

considering it contained a large proportion of meat. On examining this biscuit, I found it did contain some meat, as was stated ; but the meat had been dried to such an extent that it was almost in a vitreous form, like glass ; it broke with a conchoidal fracture like glass or flint, and even after many days' soaking in hydrochloric acid, I was quite unable to effect much change upon it. This was naturally not an article of diet to be supplied to our unfortunate troops on a campaign. That is a danger which must always be guarded against in the case of reducing food to a small bulk by means of drying.

Then comes the question of the concentration of articles of food by removing the water to a certain extent. This really forms the method of drying most kinds of food ; but when it is spoken of in the form of concentration, it generally refers to those liquid foods which are in common use, such as milk, beef-tea, essence of meat, and so on. Under those circumstances concentration can be carried to a considerable extent, and milk can be reduced to a small bulk and kept properly sealed for a considerable time without undergoing very much change. The only change it does seem to undergo is occasionally the separation of the butter from the rest of the milk, but this is immaterial so long as the milk remains sound.

As regards the other substances, concentrated beef-tea and essence of meat, it is desirable to say a word. You will see in the market tins and boxes of essence of meat which purport to be the entire strength of a certain number of pounds of meat. In fact it is stated that one ounce of essence of meat, for instance, is the entire strength of no less than two pounds or thirty-two ounces of meat itself. Now stated in this way this is entirely misleading. What this essence of meat really is, is the juice of the flesh, not the meat itself at all. Many years ago, an eminent French physiologist, Majendie, made an experiment which clearly shows that this essence of meat is not a nutritious substance in the proper sense at all ; because by making a strong rich soup from meat, and feeding a number of dogs with this

soup alone, and a number of other dogs with the rejected fibrine, the result was that the dogs fed on the rejected fibrine lived and flourished, whereas the others all ultimately died. I had experience of this myself many years ago. I tried with a friend, to see how long we could live on this essence of meat, taken instead of ordinary albuminate food, on the supposition that it was equally nutritious ; and after a very few days we were reduced to a state of considerable inanition, and exceedingly bad temper, which was immediately improved by the addition of a little more proper food, especially a little butter. The substances called essence of meat and beef-tea have, however, a considerable value ; but it is more as stimulants and aids to digestion—food regulators, in fact—than as actually providing nitrogen or nitrogenous matter itself. Therefore we should look upon them in this light ; they form very excellent bases for soup, and for different other articles of diet, but alone they cannot be considered as really nutritive. At the same time the use of these substances is exceedingly valuable in cases of extreme fatigue, and the administration of meat extract to troops on a long march has proved to be of great value, mixed with a proper amount of water, and sometimes added to a little wine, it has raised the flagging energies in a way that I do not think any other substance would probably have done. There are forms, however, of fluid meat which are somewhat different to these. There is here a bottle of so called fluid meat, which professes to contain not only the juices of the flesh, but also the fibrine dissolved. If this is the case then it is a form of material which certainly provides actual nutriment as well as the stimulating effect due to the juices of the flesh alone.

The usual method of preserving food, however, to at least a very large extent, is the method of preserving it in its own natural condition without concentration, by keeping it from the action of the atmosphere ; when we say from the action of the atmosphere we mean simply this, that the atmosphere contains a large quantity of minute moving

bodies called bacteria, bacilli, and so on, which all belong to a certain low class of vegetation, which have the power of exciting fermentation and putrefaction in organic matter; and it has been proved by experience that if these bodies can be kept out of an article of food it can be kept for almost an indefinite time without undergoing change. This principle has been applied with great results by Sir Joseph Lister in the treatment of wounds and other surgical complaints, and by carefully excluding all these minute bodies of the atmosphere he has been able to put an end to a large extent to the various surgical diseases such as hospital gangrene which were formerly the scourge and opprobrium of hospitals. This has been done even in some of the continental hospitals, where general cleanliness has been but little attended to. By this method an immense improvement has been made, and diseases have been prevented which otherwise would have carried off a large number of patients. Now this action of the minute bodies which takes place in our own system, also takes place in various forms in all sorts of organic matter, and if, as you know, you leave meat or any other substance exposed to the air, in a very short time putrefaction begins, and the substance becomes very rapidly unfit for use. There are several ways of preventing this: in the first place, the mere act of cooking alone is sufficient at the time to destroy all the putrefactive particles in the meat; and if after that we can prevent the attack of further particles from the atmosphere, then we can preserve our food for almost an indefinite period. That is at the base of all the different forms of preserved food, some of which I have on the table here. The food is first thoroughly cooked, then, while it is hot, and the steam is issuing out of a small aperture in the corner, the whole is sealed up and preserved for further use. In that way we can have all sorts of articles of diet preserved, and they form very valuable resources in many cases. There are, however, in some cases, dangers connected with these articles of diet. In the first place, if the food itself is not

in good order when put up, it will continue to putrefy even after it is sealed. Then, in the second place, the food, although not actually bad in the sense of putrefying, may be unwholesome in the sense that it is from animals diseased in various ways. Lastly, some dangers may arise from the materials used in the packing and putting up of the article. With regard to the first point, if the food is not thoroughly cooked, or if after being thoroughly cooked it is exposed to causes of putrefaction, it will continue to putrefy, even when shut up and enclosed in the tin, or in any other way. A very good way of testing this with regard to tinned food is to see whether the top of the tin, for instance, a tin of condensed milk, is flat or depressed. If the top is flat or depressed, it shows that no air has got in, because the expansion caused by boiling has expanded the air at the time of sealing up, and then, as it cools down again, if the whole is air-tight, the top of the tin, the most yielding part, will sink down to a certain extent. If, on the other hand, you find the top bulging out, you may be pretty certain decomposition has gone on, and when you open it you will probably have a gush of extremely foul air, which will at once warn you of the condition of things. Then again, if food is put up which comes from a diseased animal, or in any other way tainted, disease may arise in consequence of eating it. This is especially the case in meat which is suffering from measle, that is, the larva of a form of tape-worm ; or meat which contains the flesh worm, which is unfortunately found from time to time, especially in the flesh of pigs. Under those cases, if the cooking has not been very thorough, these creatures will develop in the human body, and produce painful, if not fatal diseases. But besides that, a danger may arise from the material which is used in sealing up the tins. Now where proper metal is used, and it is properly soldered, there is not very much danger. In the old method of putting up tins with rosin solder the material was tolerably free from any danger in that way, but in some cases lead has been found in articles of preserved food, and latterly I believe, particularly

in America, the soldering has been done by another method, which involves the use of chloride of zinc, which is an exceedingly poisonous substance, and if any of that gets into the meat, there will certainly be a bad result. Zinc poisoning is not so well known as lead poisoning, but we have had reason in recent times to recognise its presence from the action of different acids from articles of food on zinc vessels, especially on so-called galvanised iron vessels, which are simply iron vessels dipped in molten zinc, which take a thin coating of that metal. Under some circumstances this is attacked by articles of food kept in them, and the result is zinc poisoning is produced, which can now be easily recognised.

There is another method, however, of preserving food which has come into use of late years, and that is by the addition of certain substances to the article of food, to prevent the development or action of putrefactive particles or so called Bacteria. Various substances have been recommended for this purpose, and amongst others, Glycerine, Borax, Boracic Acid, Salicylic Acid, that is acid got from Willow bark, and some other substances, and they have been tried in various ways. It has been found with regard to the last, Salicylic Acid, that this is not by any means a desirable thing to take into the system as a habit; and impressed with this view the French Government have lately passed a very strong enactment against the use of this substance, which it had become the custom to introduce into wine to prevent it undergoing the change which some of the lighter wines are very apt to do in times of change of temperature and on carriage. The other substances I have mentioned, Glycerine, Boracic Acid, and Borax, or Biborate of Soda, are less harmful; Glycerine in fact itself is not the least harmful. It is a substance which may be taken into the system in considerable quantities. It is easily digested and oxidised; and even persons who are unable in certain conditions of health to take sugar at all, may take glycerine with freedom. We know that if we immerse substances in glycerine, they can

be kept an almost indefinite time without undergoing any change. Again, Boracic Acid and Borax are very deadly to all low forms of life. None of these can exist at all in a solution of either substance, and in consequence this has been made use of by adding these substances to the articles of food, such as milk and various other foods which have to be preserved, in order to prevent the development of these minute organisms. Now although this is certainly successful to some extent, it is a question whether it is advisable to continue to take into the system substances which are certainly deadly to one form of life, and may, so far as we know, have some very undesirable effect on the human system. This point still requires investigation. These two I have referred to have been joined in a substance called Boro-glyceride, which has been made the subject of a patent, by Professor Barff, and he has succeeded to a considerable extent in preserving articles of food. A small quantity of it may be added to soup, for instance, or to beef-tea, or milk, and will preserve it for some time without its undergoing change, which would be of great value in hot weather; but on making enquiry in one of the London Hospitals where I know this plan was in operation for some time, I find they have given it up. I do not know exactly for what reason, but it appears that they did not find it answer so well as they expected.

There is one form of prepared food I may refer to which is very important, namely, what is known as Pemmican, a substance greatly used amongst all Arctic voyagers for many years. It consists simply of well selected meat carefully cooked and dried, pounded up and mixed with a large quantity of fat and a small amount of spice. This substance, from the way in which it is prepared, will remain for a long time without undergoing any change whatever, and it is extremely nutritive. It contains no less than 35 per cent. of albuminates, and over 50 per cent. of fat. This substance is pleasant to taste, it is easily made into soup or otherwise used; but its prolonged use, unless with the addition of vegetable

food or lime juice, is certainly productive of bad results. We had that shown in the last Arctic Expedition, where the boat expeditions went away with a supply of this article but without any anti-scorbutic food, and the necessary result was that in a very short time the men suffered from scorbutic diarrhœa and were totally unable to swallow the proper amount of food.

But amongst the Hudson's Bay hunters and others who have been engaged in the Arctic regions a considerable time, this substance has been very largely used, either alone, or, as is sometimes the case, mixed with raisins and currants, which would give it a certain amount of anti-scorbutic property. But in all cases where this limited form of diet is in use, the persons using it take every opportunity of obtaining vegetable food in some form or another to assist the proper digestion of it ; all sorts of Arctic berries, and even sometimes plants of different kinds ; the partially masticated contents of the stomach of the reindeer also are greedily eaten by the Esquimaux, just as the contents of the stomach of the cow or bullock are eaten by the Caffres in South Africa, under conditions where vegetable food cannot be obtained.

Other forms of preserved food consist of the familiar forms of jam and other modes of preserving vegetable food, which all have their special use. I may mention one method of preservation which is being lately tried, and that is a way of preserving butter, when it is plentiful in summer and does not find an immediate market, for use in winter when it is expensive and difficult to get. We all know that there is a considerable difficulty in getting a sufficient amount of fat in our diet, and in consequence of the high price of butter there have been introduced a great many substances known as butterine, olco-margarine, and the like, which rumour says are often derived from very unsavoury sources. People have even gone so far as to say that the scum from the surface of the Thames, at the Barking and Crossness outfalls, is skimmed and the fat melted out, which is converted into buttcrine. I do not think that is practi-

cally the case; there are other uses for fat of this description, but certainly we had before the Royal Commission on Metropolitan Sewage Discharge one or two individuals whose sole occupation in life consisted in skimming this greasy like substance from the surface of the Thames, rendering it, and selling it; but they would not commit themselves to where it went, or what use was made of it. Of course there is no reason why such substances as butterine and imitation butter should not be perfectly wholesome if made of fat obtained from proper sources. But the method of preserving butter I was referring to is a plan which has been but lately introduced, by keeping the butter in a cool dry chamber, hermetically sealed from the external air. And at Berkeley Castle, Lord Fitzhardinge, who takes a great interest in dairy farming, has constructed an arrangement of this sort, and the experiment is going to be tried this summer, I hope with success, because it will perhaps to some extent cheapen the price of butter, which has become so high, especially in the winter. The importance of having a considerable amount of fat is very great for the community generally. It was even said, forty or fifty years ago, by a very wise and eminent physician, that one of the causes of the great prevalence of consumption in this country was the high price of butter; and I believe that although this was a very sweeping statement, it certainly was not untrue. If we could get a larger amount of fat introduced into the diet of the people it would be highly beneficial, and we know that in the case of consumptive patients great benefits are derived from the taking of cod liver oil or other similar fats.

I am afraid I have now reached the end of my time, and I have only to thank you for your kind attention.

The CHAIRMAN: Ladies and gentlemen, I am sure you will join with me in returning a vote of thanks to Professor de Chaumont for his excellent lecture. He has shown you that the body is a machine, and that there are two functions in the body with regard to nutrition. There is the continual waste of the parts of the machine, and that

has to be made up with materials fit for its structural parts, that are called the albuminates. They are exactly of the same composition as the flesh and blood of an animal. If you take the cheese out of milk, or if you take the cheese out of beans and peas, for beans and peas contain about 20 per cent. of cheese, and the Chinese make cheese out of them ; or if you take it by stirring the blood of an animal, or if you take it by stirring the juice of a cauliflower or cabbage, and you put these dried substances into a chemist's hands, with the dried flesh or dried blood of any animal, the chemist is unable with all his refinements and all the delicacy of his balance, to find the slightest difference between them. These substances have to be built into the body ; they are already the composition of the body. It is the duty of plants out of the aerial food around them, to mould them into the forms of flesh and blood. The animals have only to give them a position in their organisms. They are not troubled with making the materials, and therefore the building up of the machine from these albuminates is simply the placing them in position to replace the wasted parts of the machine. I am quite sure that if I were to ask nine tenths of you how long a body takes to waste—how long the machine that we have to build up, which is continually going on, some parts of it, such as the heart, from our birth to our death without the slightest cessation of work, will take to waste—you would answer me according to the old statement, which you believe as firmly as any creed of any church, that the body changes in seven years. Now the soft parts of the body, the muscles and so on, change every six weeks, or nearly that time. The waste, as indicated by the waste matter that goes away from the body, represents an amount that in about six or seven weeks amounts to the whole weight, so that in that time we must restore it entirely. Therefore it is of extreme importance, as Dr. de Chaumont has shown you, that we should put in as much as is wasted. About four ounces a day of flesh-formers must be used to keep a man in health, in ordinary active work ; it is not

enough for a labourer. If a man is doing very hard work he requires about an ounce more, or five ounces. But sometimes, from ignorance of this, the most miserable effects on nutrition have been produced. There is an incessant change of particles in our body. I cannot raise my hand without the muscles which I use being wasted, and it is the duty of nutrition to restore those wasted parts. There is incessant death and incessant life going on in every part of the body. Every particle of the body is dying according as it is used, and every particle is born again by being built in and becoming a new part of life. Therefore you see the importance of knowing the constituents of food, and showing how different materials should be used under different circumstances ; some years ago, for instance, I had the melancholy duty of being a commissioner on the Irish famine ; and where there was very little money it was very desirable to feed the largest number of persons with a small amount of money ; and a knowledge of food became of infinite importance on such an occasion.

For instance, supposing I have the duty to put a pound of flesh on a man in a day, or series of days ; for he only requires four ounces a day, and he would require four days to get a pound ; and if it was my duty to put a pound of flesh on a man, it would cost me 1*s.* 8*d.* to 2*s.* to do that out of flesh ; 1*s.* 4*d.* to do it out of potatoes : but in the shape of peas I could do it for 3*d.* Now I will come to my practical conclusion. When you go through the Exhibition you will find in the Central Hall, half way down, all the foods analysed or split into their constituent parts, according to pound weights of each. It comes to no more information than is on this table on the wall, but it is in a convenient form. You will see of each food one pound contains so much water ; so much flesh-formers, or albuminates ; so much heat-givers, because you have to give fuel to the machine to keep up the heat ; so much mineral matter to form bone ; and you will find every food there split up into its constituent parts of a pound ; and it is a very instructive set of cases but I am afraid it is passed

over without being looked at so much as the more attractive things. However, I find I am giving a lecture instead of moving a vote of thanks, which is what I rose for the purpose of doing, and which I now do.

The vote of thanks was carried unanimously.

Mr. A. J. R. TRENDELL then moved a vote of thanks to Sir Lyon Playfair for his kindness in coming to act as chairman in the midst of absorbing parliamentary and professional duties. He felt sure that the meeting would appreciate the very practical remarks the chairman had made, and begged to thank him on behalf of the executive council for presiding. The resolution was carried unanimously.

LONDON: PRINTED BY WILLIAM CLOWES AND SONS, LIMITED,
STAMFORD STREET AND CHARING CROSS.

OFFICIAL PUBLICATIONS.

The following Handbooks upon subjects cognate to the International Health Exhibition are already published, or in active preparation :—

HEALTH IN THE VILLAGE. By Sir HENRY W. ACLAND, K.C.B., F.R.S. *Illustrated.* [*Now Ready.*

HEALTHY NURSERIES AND BED-ROOMS, INCLUDING THE LYING-IN-ROOM. By MRS. GLADSTONE. [*Now Ready.*

HEALTHY AND UNHEALTHY HOUSES IN TOWN AND COUNTRY. By WILLIAM EASSIE, C.E., F.L.S., F.G.S., etc., with an Appendix by ROGERS FIELD, B.A., M. INST. C.E. *Illustrated.* [*Now ready.*

HEALTHY FURNITURE AND DECORATION. By ROBERT W. EDIS, F.S.A., Architect. *Illustrated.* [*Now Ready.*

HEALTHY SCHOOLS. By CHARLES E. PAGET, M.R.C.S. [*Now Ready.*

HEALTH IN THE WORKSHOP. By JAMES B. LAKEMAN, Esq., H.M. Senior Metropolitan Inspector of Factories, Home Office. [*Now Ready.*

ON VENTILATION, WARMING, AND LIGHTING FOR DOMESTIC USE. By Captain DOUGLAS GALTON, C.B., F.R.S. *Illustrated.* [*Now Ready.*

DIET IN RELATION TO HEALTH AND WORK. By A. W. BLYTH, M.R.C.S., F.C.S., &c. [*Now Ready.*

ON THE PRINCIPLES OF COOKING. By SEPTIMUS BERDMORE. [*Now Ready.*

FOOD AND COOKERY FOR INFANTS AND INVALIDS. By Miss WOOD, with a Preface by W. B. CHEADLE, M.D., F.R.C.P. [*Now Ready.*

ALCOHOLIC DRINKS. By JOHN L. W. THUDICHUM, M.D., F.R.C.P. (Lond.), etc. [*Now Ready.*

WATER AND WATER SUPPLIES, AND UNFERMENTED BEVERAGES. By Professor ATTFIELD, Ph.D., F.R.S. [*Now Ready.*

ENGLISH AND EXOTIC FRUITS. By W. T. THISELTON DYER, M.A., C.M.G. *Illustrated.*

SALT AND OTHER CONDIMENTS. By J. J. MANLEY, M.A.

LEGAL OBLIGATIONS IN RESPECT TO DWELLINGS OF THE POOR. By HARRY DUFF, M.A., Barrister-at-Law ; with a Preface by ARTHUR COHEN, Q.C., M.P. [*Now Ready.*

"OUR DUTY," or MORAL RESPONSIBILITY OF THE INDIVIDUAL IN REGARD TO HEALTH. By G. V. POORE, M.D., F.R.C.P. [*Now Ready.*

PUBLIC HEALTH LABORATORY WORK. By W. W. CHEYNE, F.R.C.S. ; W. H. CORFIELD, M.D., M.A., F.R.C.P. ; and CHARLES E. CASSAL, F.I.C., F.C.S. *Illustrated.*

PHYSIOLOGY OF DIGESTION AND THE DIGESTIVE ORGANS. By ARTHUR GAMGEE, F.R.S. *Illustrated.*

FERMENTATION. By Dr. DUCLAUX ; with a Preface by M. LOUIS PASTEUR, Membre de L'Institut.

INFECTIOUS DISEASE AND ITS PREVENTION. By SHIRLEY F. MURPHY, Medical Officer of Health to St. Pancras. [*Now Ready.*

CLEANSING STREETS AND WAYS IN THE METROPOLIS AND OTHER LARGE CITIES. By WILLIAM BOOTH SCOTT.

LONDON WATER SUPPLY. By Colonel Sir FRANCIS BOLTON, C.E.

FIRES AND FIRE BRIGADES. By Captain EYRE M. SHAW, C.B. *Illustrated.* [*Now Ready.*

ATHLETICS ; or, PHYSICAL EXERCISE AND RECREATION. Part I. By Rev. E. WARRE, M.A., Eton College. *Illustrated.* [*Now Ready.*

ATHLETICS. Part II. By Hon. E. LYTTELTON, M.A., and GERARD F. COBB, M.A.

DRESS, AND ITS RELATION TO HEALTH AND CLIMATE. By E. W. GODWIN, F.S.A. *Illustrated.* [*Now Ready.*

ACCIDENTAL INJURIES: THEIR RELIEF AND IMMEDIATE TREATMENT. How to PREVENT ACCIDENTS BECOMING MORE SERIOUS. By JAMES CANTLIE, M.A., M.B., F.R.C.S. *Illustrated.* [*Now Ready.*

THE AMBULANCE. By Surgeon-Major EVATT, M.D., A.M.D. *Illustrated.* [*Now Ready.*

THE INFLUENCE OF SCHOOLS OF ART ON MANUFACTURING INDUSTRY. By JOHN SPARKES.

LONDON: WILLIAM CLOWES & SONS, LIMITED,
INTERNATIONAL HEALTH EXHIBITION, & 13, CHARING CROSS.

LONDON: PRINTED BY WILLIAM CLOWES AND SONS, LIMITED, STAMFORD STREET AND CHARING CROSS